Form ESA-B4. Summary Report for ESA-084-3
Public Report - Final

Company	United States Steel Corporation	**ESA Dates**	May 19 - May 21, 2008
Plant	Granite City Works	**ESA Type**	Pumping (PSAT)
Product	Steel: hot rolled and coated sheet steel product producer	**ESA Specialist**	Joe Junker

Brief Narrative Summary Report for the Energy Savings Assessment:

Introduction:
Pump specialist Joe Junker spent 3 days working with a team at the U. S. Steel - Granite City Works performing a "training assessment."

Objective of ESA:
The objective of this assessment was to identify opportunities for efficiency opportunities in pumping systems and to introduce plant and corporate personnel to use of PSAT.

Focus of Assessment:
The assessment focused on specific pumping systems. Two teams worked to collect data on and analyze operation of:
- De-scale Pumps
- Laminar Pumps
- Reservoir Pump

Approach for ESA:
The first day of the assessment was spent in training and initial data collection and analysis. The second day was spent wrapping up data collection and analysis. The final day was spent reviewing results, summarizing them in a presentation, and presenting them to the local plant leadership team.

General Observations of Potential Opportunities:
- Indicate total plant natural gas consumption for base year, 2006:
  9,577,298 MMBtu

- Indicate total plant electricity consumption for base year, 2006:
  552,283,000 kWh

- Note what you would expect would be Near Term, Medium Term, Long Term opportunities. See definitions below:

  - ❑ Near term opportunities would include actions that could be taken as improvements in operating practices, maintenance of equipment or relatively low cost actions or equipment purchases.

    1. **Install accurate pressure monitoring and develop in-house ability to measure flow for diagnostic purposes. Follow-up with a general evaluation of pumping system efficiency.**
       - Pumps can meet process needs while working significantly off of their best operating point. Because operational requirements are met, excess cost can go unidentified. Good flow, pressure and amperage data enables plant personnel to evaluate pump efficiency and identify inefficient pump operation and associated costs
       - Reliable pressure and flow data can also allow better honing of process parameters.

2. **Evaluate flows and pressures delivered to end uses to confirm all is required and make any possible reductions that would have no adverse effect on production.**
   - Excess flow and pressure adds cost to a process without adding value.
   - On casual discussion it appears there may be an opportunity to reduce the pressure of flow delivered to the Cold Mill. Evidently it has operated at 60 PSI without apparent ill affect. This is worth pursuing; as It might not be necessary to add a booster pump in item #4 below. This would save on both implementation cost and an additional $19,000 a year in operating cost.
   - It would not be unusual for a more direct focus on evaluating other end uses to surface other opportunities

- ❑ Medium term opportunities would require purchase of additional equipment and/or changes in the system such as addition of recuperative air preheaters and use of energy to substitute current practices of steam use etc. It would be necessary to carryout further engineering and return on investment analysis.

3. **Install VFD on Hot Mill Laminar Pumps to control flow and stop bypassing**
   - Three of five 250 HP Laminar Pumps were operating during the assessment. (According to staff, sometimes only two operate)
   - Staff estimates that 50% of total flow is bypassed annually
   - VFD control will offer energy savings and better process control. (It is currently difficult to reduce flow sufficiently on occasion when needed)
   - System friction losses will reduce operating cost significantly with reduced flow, but the exact variation in the flow profile is not available. Savings will be somewhere between the extreme limits of maximum savings with continuous operation at half flow ($171,063) and minimum savings with full flow for half the time ($97,750). Savings are estimated to be half way between these two limits.

4. **Replace pump 51 with an optimum pump, set to lower pressure, and add booster pump at end use for higher pressure flow.**
   - Pump 51 is a 600 HP pump that develops an outlet pressure of137 PSI and an estimated flow of 4100 GPM (based on pressure and the pump curve). It serves two end use applications, with approximately ½ of the flow delivered to each
     - The Cold Mill requires 90 PSI
     - The Steel Works Header requires 60 PSI
   - Annual Energy & Cost: 2,900 MWH, $176,000
   - It is recommended to replace this pump with one sized to operate at optimum efficiency while developing a 60 PSI outlet pressure at current flow, and adding a second optimally sized booster pump at the cold mill to boost pressure an additional 35 PSI (5 PSI greater than the specified required mill pressure).
   - This solution has the advantage of offering the plant additional operation flexibility
   - Before implementation, flow should be confirmed along with the minimum pressure really required by the cold mill as suggested in item 2 above.

- ❑ Long term opportunities would require testing of new technology and confirmation of performance of these technologies under the plant operating conditions with economic justification to meet the corporate investment criteria.

5. **Improve Descale Pump Efficiency**
   - Assessment data indicates that the Descale Pumps operate at ~56% efficiency.
   - A pump selected to operate at optimum efficiency for these flow and pressure conditions can achieve ~85% efficiency.
   - Improved efficiency would likely require new pumps

   (Assessment data should be verified before implementation, these estimates are based on an in-line pressure gage of uncertain accuracy, and a non contact flow meter reading that is inconsistent with flow expectations based on pump curves)

6. **Reduce Descale Pump load in idle (dead head) operation**
    - There are four 3500 HP Descale Pumps. Two typically operate at a time to remove scale from slabs in the Rolling Mill. Flow is only required 38% of time that the mill is rolling steel. The mill is actively rolling steel for only 80% of the mill's 6 operating days a week. The pumps are on continually for 6 days a week. As a result the pumps operate in a no flow "dead head" condition for 60% of the year at a cost of $804,000 and 13,400 MWH a year.
    - While not a trivial task, significant savings could be captured by reengineering control of these pumps to relax their load when no flow is required.
    - Mill Delay related dead head operation lasts longer and might be easier to capture. This currently costs $231,000 a year.
    - When the mill is rolling steel, dead head operation occurs in short cycles of 1-2 minutes and presents more challenges. This currently costs $573,000 annually.
    - Strategies and equipment to reduce costs associated with no flow pump operation might include:
        - Softstart (if only attempting to capture "Mill Delay" savings) or Variable Speed Drive operation (if attempting to capture all savings potential). This would represent a significant cost and quite a design challenge for these 3500 HP Motors.
        - Addition of a smaller pilot pump to maintain header pressure when unloading and re-loading the primary pumps.
        - Additional pressure vessel capacity to "carry" the load while the primary pumps spin up to speed as needed.
    - Any solution will need to be very robust as insufficient descaling is unacceptable.
    - Savings are estimated at 80% of total dead head operation cost, but actual obtainable savings could vary significantly from this.

- Estimate, if possible, the identified % plant fuel savings from a) Near Term opportunities; b) Medium Term opportunities, c) Long Term opportunities.

  NA (no fuel savings)

- Estimate, if possible, the identified % electricity savings from
  a) Near Term opportunities;
  Not quantified

  b) Medium Term opportunities,
  22%

  c) Long Term opportunities.
  78%

Management Support and Comments:

DOE Contact at Plant/Company: (who DOE would contact for follow-up regarding progress in implementing ESA results…)

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